

Chapter 7. Displaying, Modifying and Mapping Inventories

Chapter 6 discussed how to enter data and import databases. Once your data is entered into HAZUS, you have a number of options available for displaying and modifying the data.

7.1 Editing a Database

Data within a database can be edited by double clicking on the spreadsheet cell containing the data you want to change. Highlight the text you wish to modify and your typing will replace the highlighted text.

7.2 Printing Out a Database

All databases can be printed out using the **Print** button at the bottom of the window.

7.3 Modifying Occupancy to Model Building Type Relationships

From the **Inventory|General Building Stock|Occupancy Mapping...** menu a spreadsheet, such as the one shown in Figure 7.1, will appear. In this particular example the default mapping is for a low seismic region as shown in the Design Level list box in the upper left corner of the window. If the region you are studying happens to be moderate or high seismic, the spreadsheet will be populated differently and the Design Level list box will indicate a moderate or high design level.

The design level designation is tied to the damageability of a structure reflected in the damage functions (fragility curves). Fragility curves are discussed in Chapter 9 of this manual and in the *Technical Manual*. The design levels correspond to map areas in the document *NEHRP Recommended Provisions for the Development of Seismic Regulations for New Buildings* (FEMA, 1991a). High seismic design corresponds to map area 7, moderate seismic design to map areas 5 and 6, and low seismic design to map areas 1 through 4.

Each row of the spreadsheet represents an occupancy class and each column represents a model building type. For this example, low-rise construction (RES3) consists of 73% W1, 2% S3, 3% S4L, 6% C2L, 1% C3L, 1% PC2L, 9% RM1L and 5% MH (see Table 3A.4 of the Technical Manual). Many of the model building types are not visible in Figure 7.1, but can be seen by scrolling to the right on your screen. The sum of the model building type percentages for each occupancy is found in column 2 of the spreadsheet, entitled "Total".

It should be noted that three default occupancy-to-model-building-type mapping schemes have been developed (West Coast, Mid-West and East Coast) and are found in Appendix 3A of the Technical Manual for general building stock and Appendix 3B for essential facilities. Appendix 3C summarizes which of these three groups is identified with each of the fifty states. Finally, it should be noted that at the present time the mapping schemes for Pre-1950, 1950-1970, and post-1970 differ only in the West Coast region.

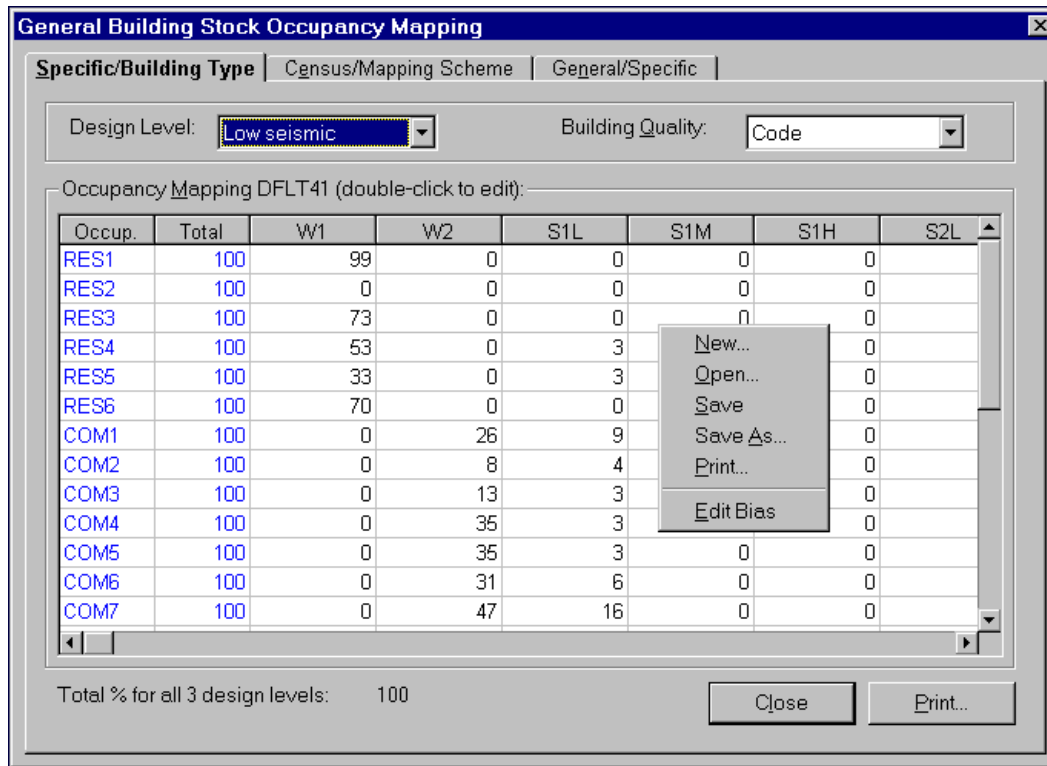


Figure 7.1 Window displaying a specific occupancy to model building type mapping scheme.

The data management menu shown in Figure 7.1 allows you to open other mapping schemes if they exist. Using the right mouse button, click anywhere on the spreadsheet to access the data management menu. Click on **Open...** and the dialog box shown in Figure 7.2 will appear. This dialog box shows you all of the occupancy to model building type mapping schemes that have been defined for your region. In this example, two default schemes are available: DFLT41 and DFLT41L. The description of the mapping scheme (in this case, Oregon State (Default)) can be seen in the lower portion of the window.

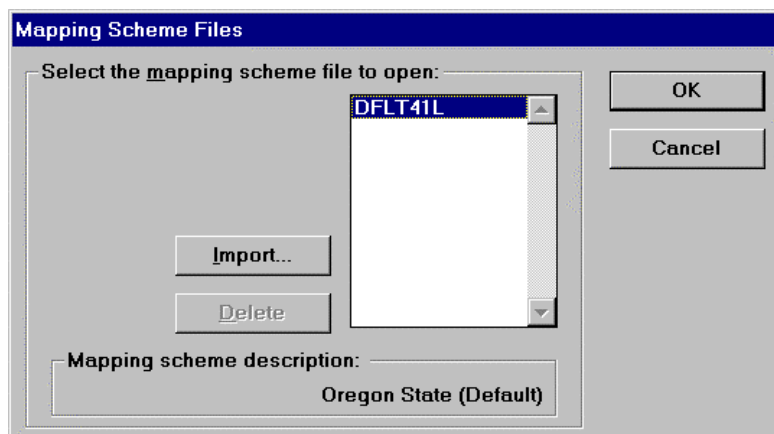


Figure 7.2 Selecting a model building type to occupancy mapping scheme

To view a scheme, highlight the file name of that mapping scheme and click on **OK**.

7.3.1 Modifying the Mix of Age and Building Heights

The default occupancy to building type mapping is based upon a default mix of ages and heights. The default mapping scheme varies by state and is displayed when the user opens the window displayed in Figure 7.1. It is possible that different census tracts within the study region will have different age and height mixes. A downtown area might have a large percentage of high-rise structures, whereas a residential area may not. To override the default the user can use the New Mapping Scheme Parameters window shown in Figure 7.4.

As an example of the use of the New Mapping Scheme Parameters menu, suppose you determined that 50% of the buildings in a census tract were low-rise and 50% were mid-rise, and that 50% of the buildings were built before 1950, 30% between 1950 and 1970 and 20% after 1970. Before you modify your mapping scheme, you should save it under a new name by clicking on the right button of your mouse and selection the **Save As** option shown in Figure 7.1. Clicking the right mouse button with the pointer positioned over the spreadsheet accesses the data management menu. After typing a new name (for this example - NEWMIX) and a description of the mapping (see Figure 7.3) click on the **OK** button.

Figure 7.3 Saving a mapping scheme under a new name.

Clicking on the right mouse button anywhere in the table and choosing the option **New** as shown in Figure 7.1 can create the New Mapping Scheme Parameters window. Once the age and height percentages have been set as shown in Figure 7.4 and you have clicked the **OK** button, a new occupancy mapping automatically will be calculated. You will be asked to confirm that you want to overwrite the mapping scheme (see Figure 7.5). Click **OK** and you will be presented with the modified mapping shown in Figure 7.6. A detailed discussion of how age and height are used to modify the mapping scheme is found in Section 4.5. It is important to keep in mind that changing the age distribution only changes the percentages of building types. It does not change the design level. The design level is changed by using the **Edit Bias** option (Section 7.3.2).

New Mapping Scheme Parameters (%)

Age:		Height:		OK
Pre-1950:	50	Low-rise (1-3 stories):	50	
1950 to 1970:	30	Medium-rise (4-7 stories):	50	
Post 1970:	20	High-rise (8+ stories):	0	Cancel
Building Quality (Bias):		Design Level:		
Code:	25	Low seismic:	100	
Inferior:	75	Moderate seismic:	0	
Superior:	0	High seismic:	0	

Figure 7.4 New Mapping Scheme Parameters window.

HAZUS

The new age, height and quality bias values will generate a new mapping scheme file. Do you want to overwrite the current one?

Yes No

Figure 7.5 Confirmation window for overwriting a mapping scheme.

General Building Stock Occupancy Mapping

Specific/Building Type | Census/Mapping Scheme | General/Specific

Design Level: Low seismic Building Quality: All types

Occupancy Mapping: NEWMIX (double-click to edit):

Occup.	Total	W1	W2	S1L	S1M	S1H	S2L
RES1	100	99	0	0	0	0	0
RES2	100	0	0	0	0	0	0
RES3	100	36	0	0	6	0	0
RES4	100	22	0	3	7	0	0
RES5	100	14	0	2	6	0	0
RES6	100	26	0	0	10	0	0
COM1	100	0	11	2	6	0	0
COM2	100	0	5	2	7	0	0
COM3	100	0	10	1	7	0	0
COM4	100	0	14	1	13	0	0
COM5	100	0	14	1	13	0	0
COM6	100	0	10	3	9	0	0
COM7	100	0	15	5	10	0	0

Total % for all 3 design levels: 100

Close Print...

Figure 7.6 Mapping scheme modified to reflect user defined age mix

7.3.2 Modifying the Mapping Scheme to Reflect Different Design Levels

The bias refers to whether the structures are built to code, are superior to the code or inferior. The default is that 25% of buildings are built to code and 75% are inferior. The bias is described in detail in Section 5.7 of the *Technical Manual*. The default bias should be used unless you have an in-depth understanding of building practices in your region.

HAZUS gives you the option to define a mix of design levels for each model building type. A mix of design levels can occur when structures are built at different times and are designed under different codes. The damage functions provided in the damage module are based on current NEHRP provisions (FEMA, 1991a) and are intended to represent current code provisions. Damage functions are developed for each of three seismic design regions, defined in terms of the 1994 NEHRP Provisions map areas: High Seismic Design (Map Area 7), Moderate Seismic Design (Map Areas 5 and 6), and Low Seismic Design (Map Areas 1 to 4).

In those regions that have not enforced seismic design codes or have a number of buildings that do not meet current standards, the damage functions may under-predict damage. In contrast, the damage functions may over-predict damage for buildings that are designed/constructed for performance beyond code requirements. The latter case is not expected to include a large population of buildings and is not expected to affect regional damage/loss estimation. The year when seismic provisions were included in building codes varies by region. The user should consult a local structural engineer or the local building department to determine what year seismic design provisions was enforced. Section 5.7 of the *Technical Manual* and FEMA publication 154 provide some general guidelines for different regions of the United States.

Users may tailor the damage functions to their study area of interest by determining the appropriate fraction of each building type that conforms essentially to current code provisions (for example, High in California, Moderate and Low in Florida) and the fraction that is substandard by a significant degree. Buildings that are considered significantly substandard would be assigned a lower seismic design group. For instance, certain types of older buildings in Map Area 7 should be evaluated using damage functions for Map Areas 5 & 6. Such buildings would include concrete moment frames (Building Type C1) on the west coast built prior to the mid-1970's. Buildings over 60 years old were likely designed only for wind and at least a portion of these older buildings may best be evaluated using the damage functions developed for Map Areas 1-4. To modify defaults, users must be knowledgeable about the type and history of construction in the study region of interest and apply engineering judgment in assigning the fraction of each building type to a seismic design group.

To clarify how to develop an occupancy mapping to reflect different design levels, assume that a census tract within the study region has a mixture of construction so that the RES1 occupancy mapping is as shown in Table 7.1. In this example, 73% of all single-family dwellings (RES1) are low-rise wood frame (W1), 5% are steel light frame (S3) and so on. Although this census tract is in a high seismic region, some of the structures were built before seismic design criteria were adopted. Thus 50% of all RES1 are seismically designed W1, 15% are moderate seismic W1 and 8% are low seismic W1.

An example of a low seismic construction would be a house with an unbraced cripple wall. All building types that are not shown in Table 7.1 are not present in the hypothetical census tract. For any occupancy class, the model building type percentages across all design levels must add to 100%. This is checked and indicated in the lower right-hand corner of the table.

Table 7.1 Sample occupancy mapping for occupancy RES1 (single family dwelling)

Design Level	Model Building Type						
	W1	S3	S4L	RM1L	URML	MH	
High Seismic	50%	5%	3%	3%	0%	2%	sum = 63%
Moderate Seismic	15%	0%	0%	3%	0%	0%	sum = 18%
Low Seismic	8%	0%	0%	3%	5%	3%	sum = 19%
Total Percent	73%	5%	3%	9%	5%	5%	sum = 100%

You would enter this mapping scheme in row one of the window shown in Figure 7.2 by toggling between design levels with the **Design Level** menu and entering the appropriate values for each design level. The result is shown in Figure 7.7. Note in Figure 7.7 that the total RES1 in the high seismic design level is 63%. However the sum of all three RES1 design level totals is 100%. If the total for all design levels is not 100%, you will be given an error message when you try to save the mapping.

General Building Stock Occupancy Mapping

Specific/Building Type | Census/Mapping Scheme | General/Specific

Design Level: High seismic | Building Quality: Code

Occupancy Mapping: DFLT06H (double-click to edit):

Occup.	Total	W1	W2	S1L	S1M	S1H	S1H
RES1	63	50	0	0	0	0	0
RES2	0	0	0	0	0	0	0
RES3	0	0	0	0	0	0	0
RES4	0	0	0	0	0	0	0
RES5	0	0	0	0	0	0	0
RES6	0	0	0	0	0	0	0
COM1	0	0	0	0	0	0	0
COM2	0	0	0	0	0	0	0
COM3	0	0	0	0	0	0	0
COM4	0	0	0	0	0	0	0
COM5	0	0	0	0	0	0	0

Total % for all 3 design levels: 100

Close Print...

Figure 7.7 Mapping scheme modified to reflect different design levels.

7.4 Defining Different Mapping Schemes for Different Census Tracts

The user can create a series of occupancy mappings by modifying the default values and saving the different mapping schemes under different filenames (filename is in upper left portion of the spreadsheet in Figure 7.7). Different mapping schemes can then be assigned to different census tracts. The reason the user may wish to create different mapping schemes is that building practices may vary throughout the study region. For example, in an older area 30% of the retail buildings (COM1) may be low rise unreinforced masonry (URML), while in more recently developed areas, only 5% of COM1 may be of model building type URML.

Once a series of occupancy mapping schemes have been defined and saved using the right button mouse click **SAVE AS** option, you can then assign schemes to each census tract. This is done using the window shown in Figure 7.8. In this example, two mapping schemes have been defined (the default mapping and the new mapping that includes age and height mix). Initially, upon entering this window, all census tracts will be assigned the default mapping scheme for their particular state. You can override the default by clicking on the row number for a census tract and then double clicking on the desired mapping scheme. When you close this window, you will be asked to confirm your changes.

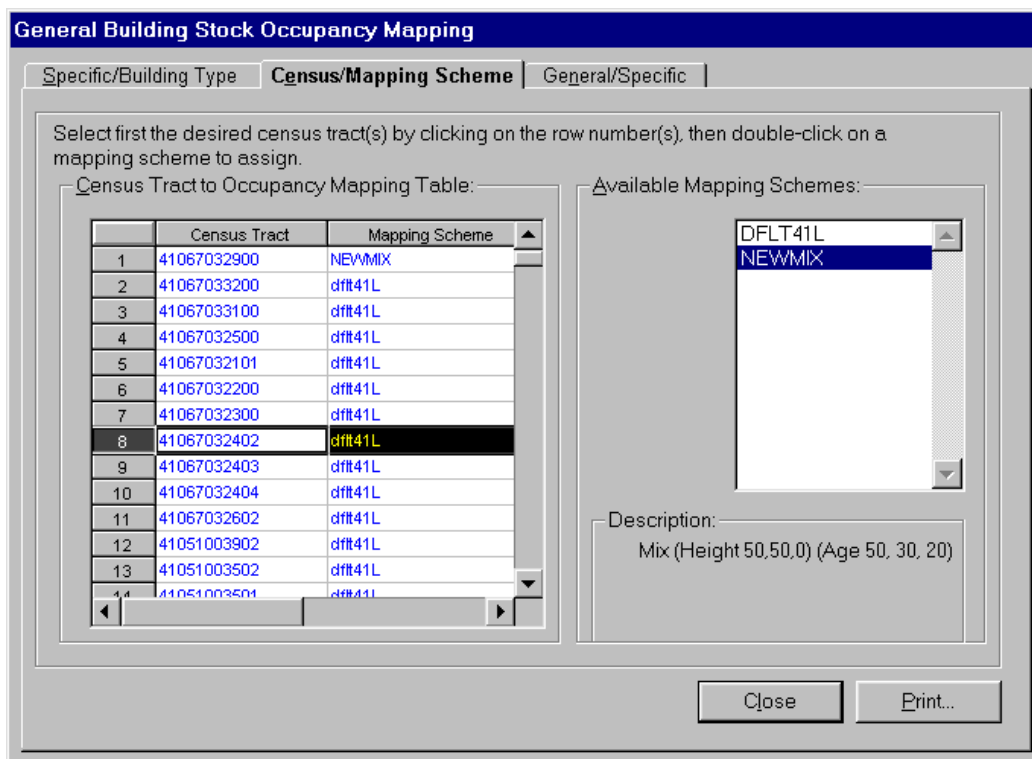


Figure 7.8 Occupancy mapping scheme assignment window

7.5 General to Specific Occupancy Mapping

You have the option to modify the distribution of specific occupancies within each general occupancy class. Within the general occupancy class Residential, there are six

specific occupancy classes as summarized in Table A.3 in appendix A. An example of the distribution of residential occupancies is shown in Figure 7.9. In this window, it is shown that for census tract 41005020600 89% of residential construction is RES1, 0% is RES2, 11% is RES3, and 0% is RES4, RES5, and RES6. Within each general occupancy class (residential, commercial, industrial, agriculture, religion/non profit, government and education) the specific occupancies must sum to 100%. Default distributions are provided in **HAZUS**. These defaults are based on the 1990 Census and 1996 Dun and Bradstreet Data. Modifications to these defaults cannot be made in the window shown in Figure 7.9 and are made by altering the dollar exposure values in Figure 7.10. This window is accessed from the **I**nventory|**G**eneral Building Stock|**S**quare Footage menu.

Occupancy	Percentage
RES1	89.39
RES2	0.00
RES3	10.61
RES4	0.00
RES5	0.00
RES6	0.00
COM1	27.84
COM2	18.90
COM3	10.60
COM4	26.29
COM5	4.30
COM6	0.00
COM7	3.04
COM8	9.05
COM9	0.00
COM10	0.00
IND1	61.55

Figure 7.9 General to specific occupancy mapping scheme.

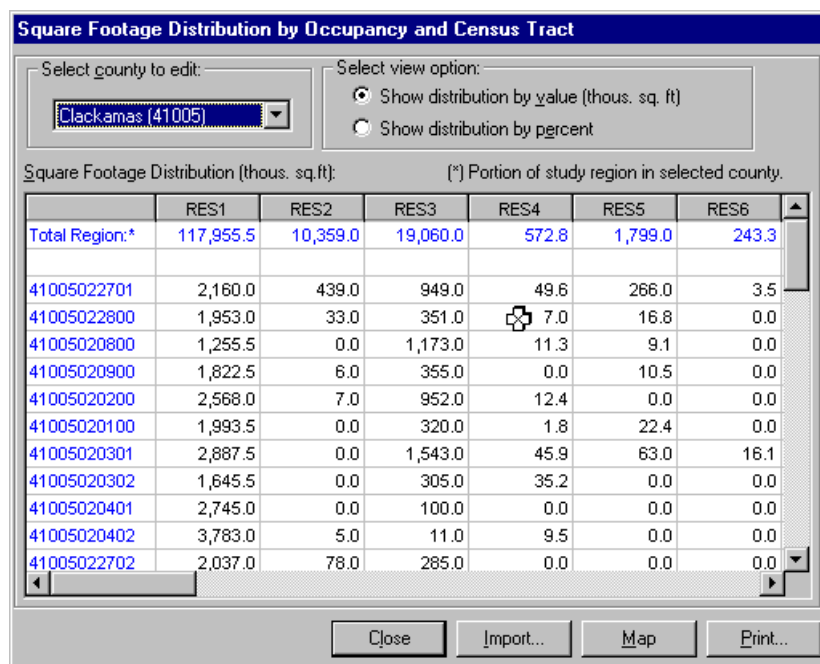


Figure 7.10 Square footage per census tract and occupancy.

7.5.1 Mapping a Database

All databases can be mapped using the **Map** button at the bottom of the window. MapInfo tools can be used to modify legends and to bring different layers to the front. Entries in site-specific databases, such as emergency facilities and lifeline components, will appear as symbols on the map. Other types of databases, such as census data, soil types, and general building stock inventory, are displayed as thematic maps. In thematic maps, shading or colors are used to display attributes of a particular region. For example, hatching represents areas with dense population, and dotting represents areas with less dense population as shown Figure 7.12.

7.5.1.1 Modifying the Ranges and Colors of a Thematic Map

When you click on the **Map** button at the bottom of a database window, a thematic map will be displayed using a default setting for the ranges and colors of data. It is very simple to customize the look of a map to meet your own needs. The following is an example of the procedure to customize a population data map.

1. Select the **Inventory|Demographics** menu option and the table shown in Figure 7.11 will appear. The database contains many attributes that can only be mapped one at a time. In order to map the population information, click on the word *Population* to highlight that column of the database. Click on the **Map** button and the map in Figure 7.12 will be generated.

Demographics

Table:

	Census Tract	Population	Households	Group Quarters	Pop. age < 16
33	41005020100	3,851	1,629	32	777
32	41005020200	5,648	2,563	0	983
34	41005020301	7,744	3,262	90	1,610
35	41005020302	3,286	1,350	0	715
36	41005020401	5,200	1,956	0	1,253
37	41005020402	7,433	2,450	0	1,961
171	41005020501	2,377	798	61	666
172	41005020502	10,138	3,621	159	2,597
173	41005020600	5,387	1,988	0	1,410
174	41005020700	2,784	996	0	761
25	41005020800	3,738	1,921	13	562
26	41005020900	3,703	1,563	15	844
190	41005021000	4,396	1,737	0	937
182	41005021100	5,356	2,031	79	1,279
183	41005021200	3,782	1,915	158	583
184	41005021300	5,551	2,149	0	1,232
185	41005021400	4,275	1,654	29	854
186	41005021500	4,185	1,652	0	842
191	41005021601	4,221	1,714	11	1,096
181	41005021602	4,041	1,582	0	883
175	41005021700	4,001	2,017	14	1,096

Close Map Print..

Figure 7.11 Highlighting the population column of the population inventory.

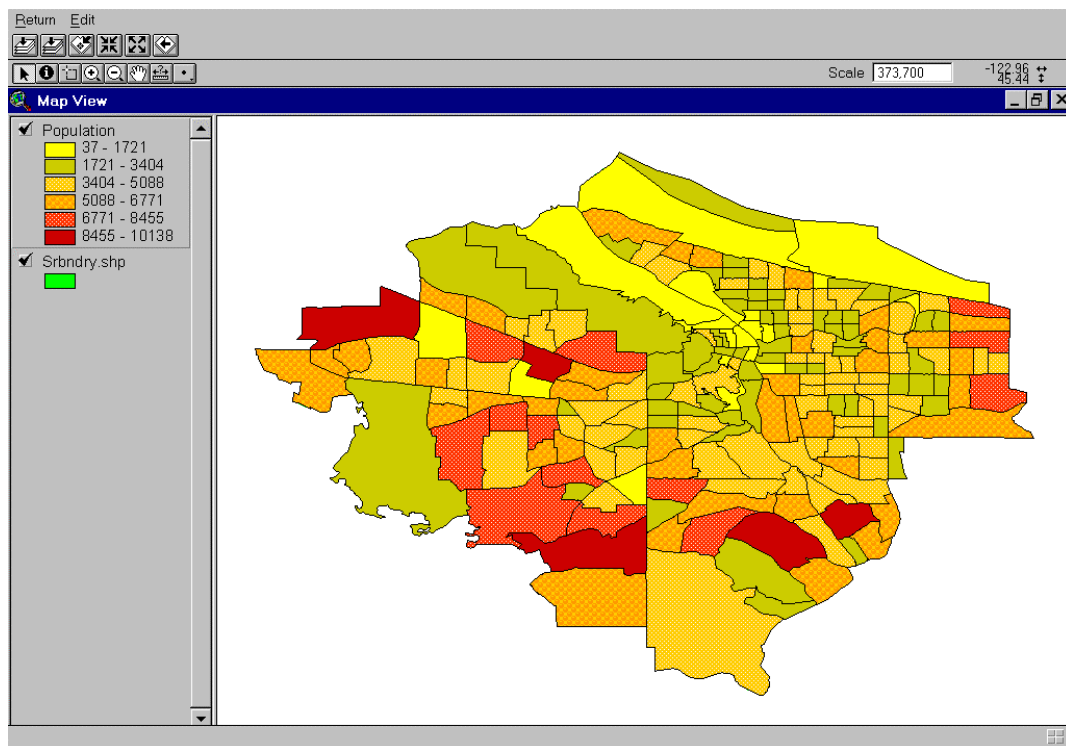


Figure 7.12 Default thematic map of population as displayed by HAZUS

2. To modify the thematic map, make the Population map the active layer by clicking on the word "Population" that appears in the Table of Contents (left side of the widow)

of Figure 7.12. Double click on the active layer (the Population Layer) and the window shown in Figure 7.13 will appear.

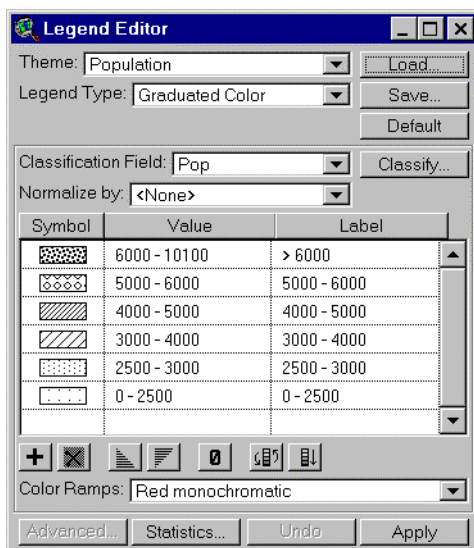


Figure 7.13 Window used to modify the thematic map characteristics

3. The **Legend Editor** window, shown in Figure 7.13, allows you to modify your data in a variety of ways. You can divide the data into as many or as few ranges as you wish by clicking on the **Classify..** button in Figure 7.13. From the **Classification** dialog box shown in Figure 7.14, you can modify the classification type, number of classes and the data round off value. For this example, we selected the Equal Interval classification type, 6 classes, and round by 1000. Click the **OK** button. The new values will be displayed in the **Legend Editor** dialog window. If you are satisfied with the new range definition, click the **Apply** button shown in Figure 7.13. If not, click on the **Classify..** button again and re-modify your classifications.

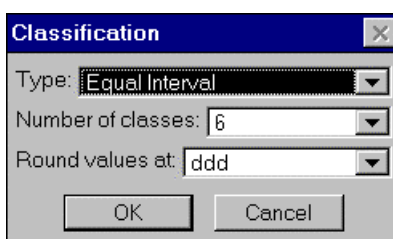







Figure 7.14 Ranges classification property window

You can also customize your own ranges and labels. From the **Legend Editor** window, you can individually highlight existing ranges under the Value column and overwrite them. You can further label that range with any value or text by highlighting the existing values listed under the Label column and overwriting them. Click on the Apply button and preview the map. If you are satisfied with the new ranges, close the **Legend Editor** window by clicking on the button in the upper right corner. If not, go back and re-modify the classifications or the ranges or both.

4. The **Legend Editor** window, shown in Figure 7.13, will also allow you to modify the symbols featured for each range. From the Legend Editor window, double click on the “symbol” that appears under the Symbol column for each range. To modify pattern, line style, symbol, font, or color, you need to access the Fill Palette, Pen Palette, Marker Palette, Font Palette and Color Palette (shown in Figure 7.15) by clicking on the following button respectively     . Once all the modifications have been implemented, a map will appear reflecting all the customized changes (Figure 7.16).

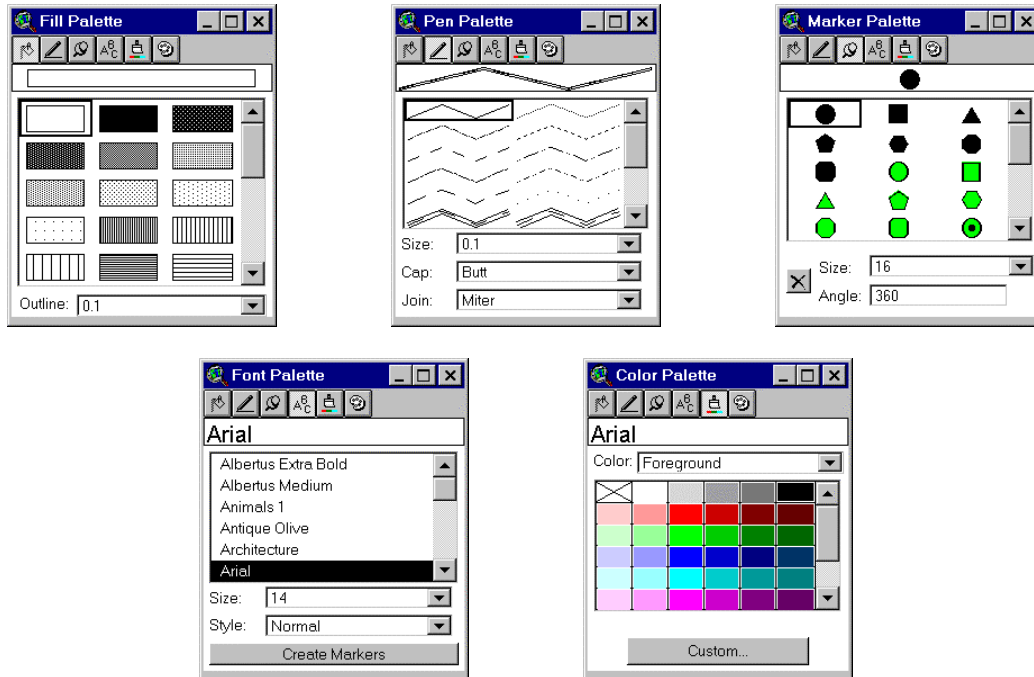


Figure 7.15 Different palettes for style modifications to the thematic map

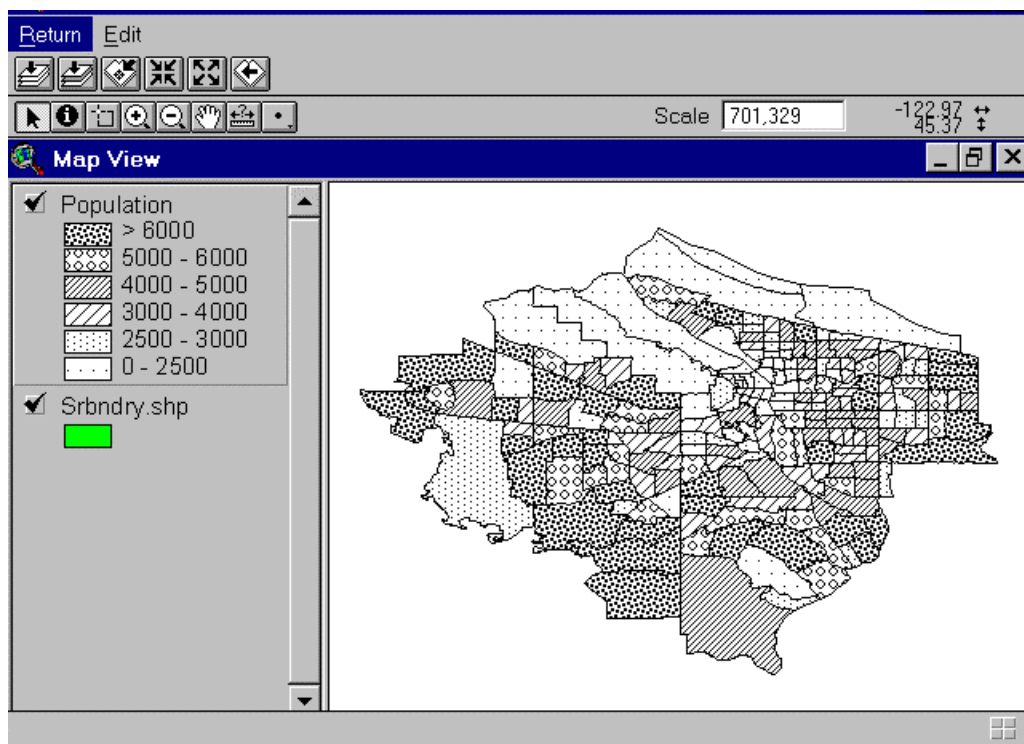


Figure 7.16 Thematic map with modifications to the range definitions

7.5.1.2 Saving a Reloading a Thematic Map Features

You have the option of saving the characteristics of a thematic map and reapplying them to the same map or a different map. To do so, click on the **Save** button in the **Legend Editor** window (Figure 7.13) and a **Save Legend** window will appear (Figure 7.17). Name the legend file and click the **OK** button.

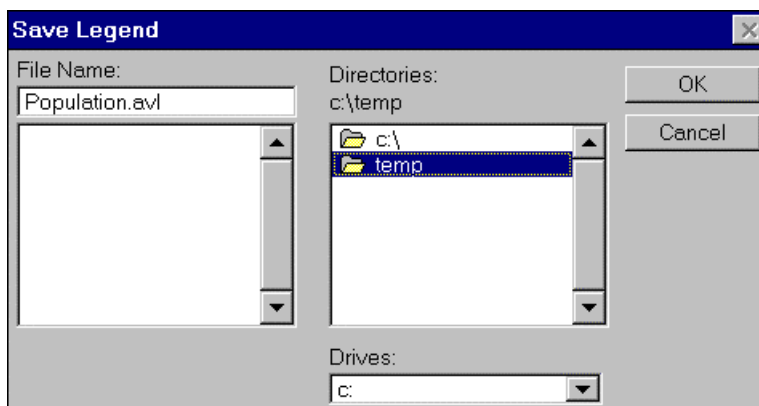


Figure 7.17 The Save Legend widow allows the saving of thematic map characteristics.

To reload a previously saved legend file, click on the **Load** button in Figure 7.13. A **Load Legend** window, such as the one shown in Figure 7.18, will appear. Navigate your drives and directory and locate the desired legend file and click the **OK** button.

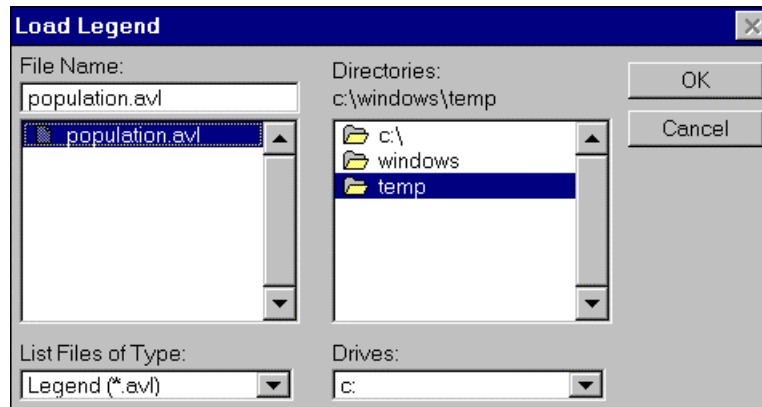




Figure 7.18 Window used to load a previously saved legend file.

Clicking the OK button will take you to another **Load Legend** window such as the one shown in Figure 7.19. You may choose to reload all the saved thematic map features by checking the *All* box or you may choose to only reload the previously saved classes and/or symbols by checking the *Classes* or *Symbols* boxes, or both.

If you want to apply the thematic map features to a different field, you can scroll among the fields in the **Load Legend** dialog box (Figure 7.19) by clicking the  button next to the **Field:** bar and selecting the new desired field. You can also change the field from the **Legend Editor** dialog box shown in Figure 7.13 by again clicking the  button next to the **Classification Field:** and selecting the new desired field.

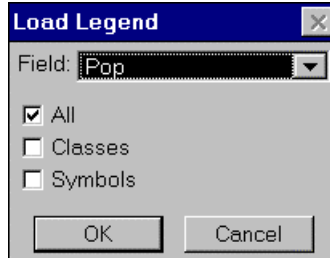


Figure 7.19 Selecting the thematic map options to be loaded.

7.5.1.3 Creating a Layout Window and Printing Maps

Layout windows are used to format maps for printing.

1. Select the **Window|New Layout Window** menu option.
2. **HAZUS** automatically generates the Layout window shown in Figure 7.20. When **HAZUS** first opens the layout, it sets the page size and orientation according to the current settings for your printer. For example, in Figure 7.20 the page was set to 8.5 X 11 inches and landscape orientation. To change these settings, go to **Layout|Page Setup...** and the menu shown in Figure 7.24 will appear. You can resize the layout window using your mouse by clicking once on the map and dragging the corner boxes that will appear at each corner of the layout window border. If the map seems too small or too big, use the “zoom in” and “zoom out” tools from the tool bar to resize it.

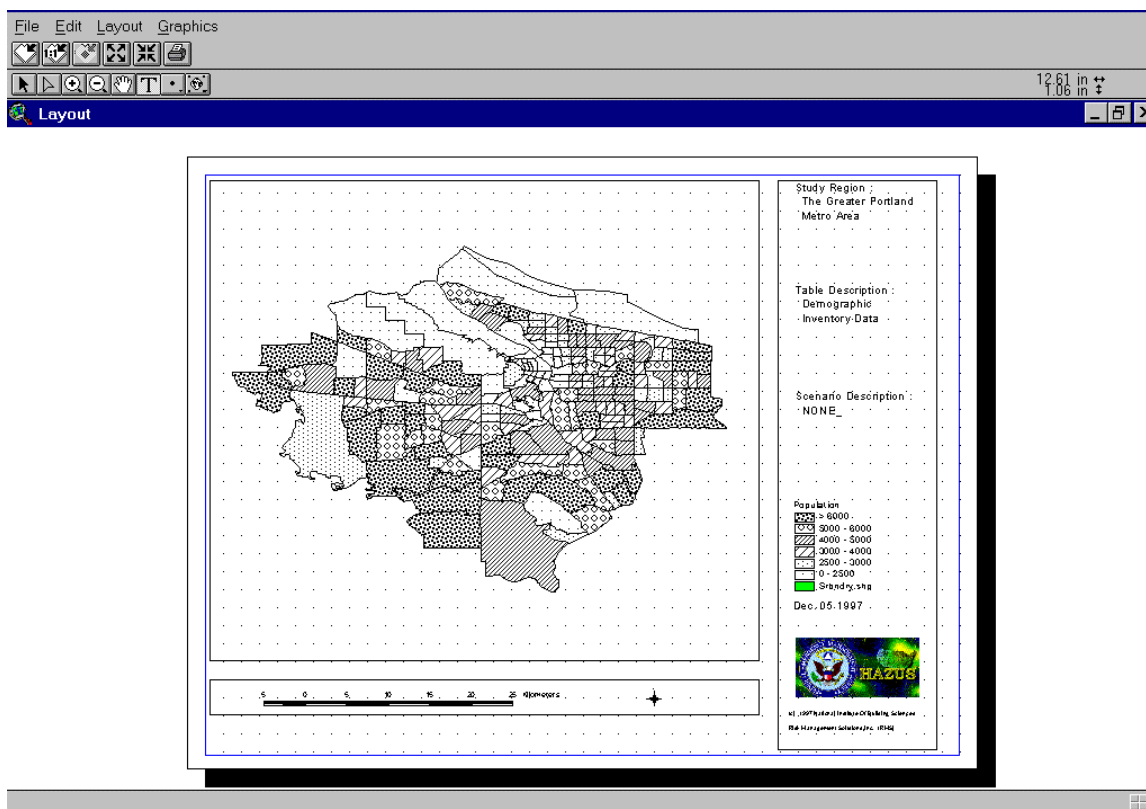



Figure 7.20 Layout window, used to modify a map for printing.

- To add a title or other labels to the map, click the **T** button from the tool bar. Click on the desired map location and the **Text Properties** dialog window will appear (Figure 7.22). Type in the appropriate label and select the desired *Horizontal Alignment*, *Vertical Spacing Line* and *Rotation Angel* and click the OK button. The location and properties of the label may be changed after the text is entered. To do so, click the  button from the tool bar and double click on the label. The **Text Properties** window will appear again and you can modify your previous entries.

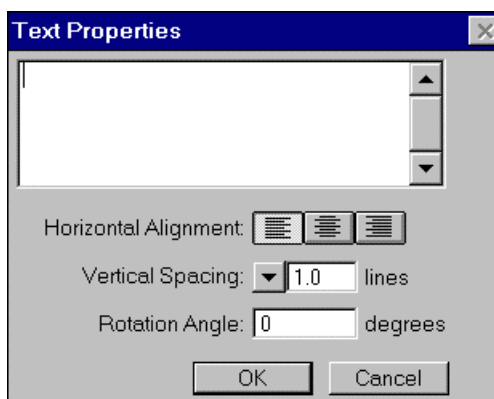


Figure 7.21 Text properties window used to add and modify map labels

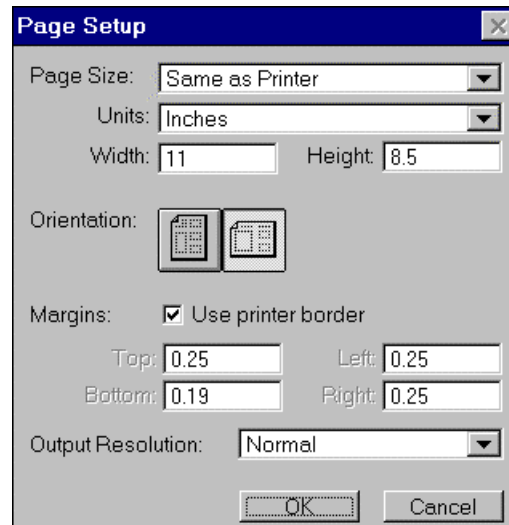




Figure 7.22 Page setup window for printing layouts

4. You can adjust the location of any object in the layout window by clicking on the  button from the tool bar. Click once on the object that you wish to move and the arrow cursor will change its shape to . With your left mouse button held down, drag the object and drop it in the new desired location.
5. You can also adjust the size and location of an object within its own frame. To do so, click once on the desired object in the layout window and select **Graphics|Size and Position**. Figure 7.23 or 7.24 will appear depending on the type of object that you have selected for modifications. The *'from top'* and *'from bottom'* values determine the margin around the object. The *height* and *width* values determine the size of the object.

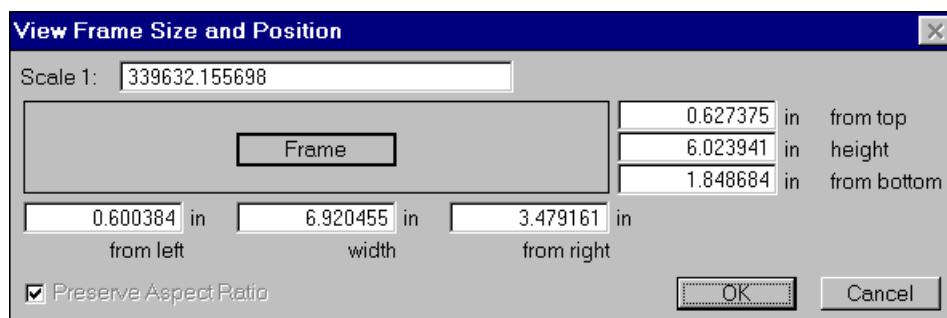


Figure 7.23 View Frame Size and Position window used to modify the location and size of a Frame

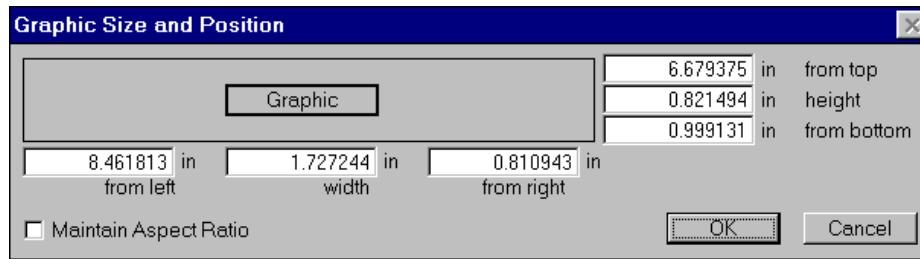


Figure 7.24 Graphic Size and Position window used to modify the location and size of a graphic object.

6. To set up the printer, select the **File|Print Setup** menu option. The dialog box shown in Figure 7.25 will appear. Adjust the settings as needed and click **OK**. To print, select the **File|Print** option and the dialog box shown in Figure 7.26 will appear. Click **OK** if you want to send the layout to the printer that you have selected under *Printer Name* in the **Print Setup** dialog box. Alternatively, you can save the layout to a file by checking the box next to *Print To a File* and typing the name in the *To file:* bar.

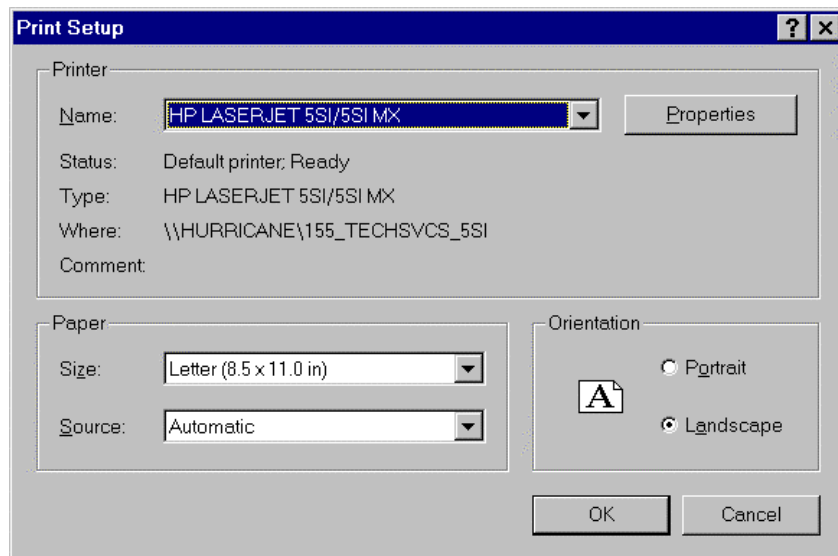


Figure 7.25 Print Setup window for printing layouts.

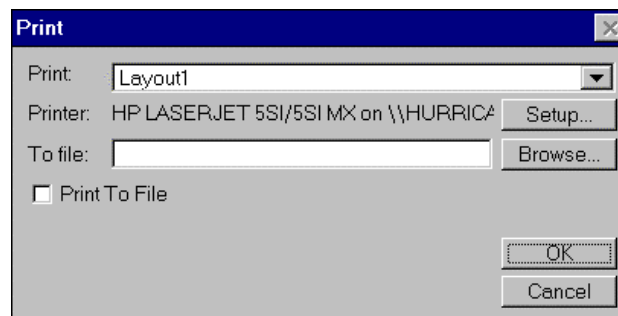


Figure 7.26 Print window for printing layouts

